



Original communication

Rising threat of terrorist bomb blasts in Karachi – A 5-year study

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ABSTRACT

Objective: This study aims to determine the frequency of injuries and fatalities associated with terrorist bomb explosions in the city of Karachi from 1 January 2007 to 31 December 2011. Moreover, this study is aimed to determine age and sex vulnerability among the victims of blast explosion.

Study design: A descriptive cross-sectional study was conducted.

Place: The study was carried out at mortuaries and medicolegal sections at Jinnah Postgraduate Medical Center, Civil Hospital and Abbasi-Shaheed Hospital Karachi, the three main hospitals, which cater to all these cases of Karachi.

Duration of study: The study included all bomb blast victims examined and autopsied from January 2007 to December 2011 at Jinnah Postgraduate Medical Center, Civil Hospital and Abbasi Shaheed Hospital Karachi.

Material and method: Details of 1142 cases were collected for those medicolegal deaths and injured persons, identified to be the victims of bomb blasts from January 2007 to December 2011. Data were collected on a preformed proforma from the mortuaries and medicolegal sections of these three public sector hospitals. The variables investigated include age, gender, year-wise distribution of the injured and the dead along with the cause of death and body parts injured in survivors.

Results: Out of the total 11,109 autopsies during the study period, 249 (2.24%) were carried out on deaths due to bomb blasts. Similarly, 135,065 injury cases were reported during the study period out of which 893 (0.66%) cases were due to bomb blasts. An initial peak in the year 2007, followed by a decline in 2008 and since then a steady rise of bomb blast incidences with casualties and fatalities, has been observed. The highest numbers of injured victims were reported in the year 2010 and fatalities in 2007. Among 1142 cases, 95.18% were male and 4.82% female with a male to female ratio of 19.76:1. Persons of ages between 15 and 45 years were chiefly involved. Shock due to multiple injuries was the leading cause of death, followed by head injury with or without haemorrhage. The lower extremities sustained the highest number of injuries in survivors, followed by the upper extremities.

Conclusion: Fatalities and casualties due to explosions are increasing each year. The pattern of injuries indicates open-air bombing in Karachi. Males of the age group 15–45 years are the main victims. The forensic speciality needs to understand their role of correct certification, helpful to law enforcement agencies.

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1. Introduction

The recent upsurge of terrorism for political and other reasons in many parts of the world has brought with it the use of explosives. An explosive is a substance resulting in rapid increase in volume and release of energy with the generation of high temperature and gases.¹ Explosions are capable of causing life-threatening and multi-system injuries in many individuals simultaneously, demanding a stock of well-trained health-care providers and

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forensic experts who can handle the situation appropriately. Both blunt and penetrating mechanisms operate in the case of explosions and produce classic injury patterns on various organ systems. Blast injuries are classified into four main types. Primary blast injury is the result of the direct effect of blast overpressure on tissue. Secondary blast injury results from flying objects that strike the person. Tertiary blast injury in which person is hurled against other objects and quaternary blast injuries include all other injuries related to explosion but not due to primary, secondary and tertiary mechanisms.^{1,2} Many factors such as the amount and composition of explosive material, environment, the distance between the victim and the blast and delivery methods are all important in the pattern and extent of injuries as a result of a bomb blast.

The war on terrorism has produced a great impact on Pakistan which has increased terrorism inside the country many folds. Terrorists target security installations, political figures and heavily crowded public places by means of explosives. Pakistan's economy has fallen drastically after the start of the destructive phenomenon of terrorism, and Pakistani officials described the costs of terrorism as approximately \$ 68 billion during the last 10 or 12 years.³ Before 1989 Pakistan fought three wars against India in which both militants and civilians suffered from massive deaths and disabilities, due to the use of explosive materials and devices. Recently, this trend has dramatically changed and now the deaths and disabilities as a result of explosion are the outcome of terrorist activities, which are prevalent not only in Pakistan but also in Afghanistan, Iraq, Sri Lanka and India.⁴

Mortality from bomb blasts varies between the incidences depending upon the surroundings, that is, either the explosion took place in open air, closed space, bus or market, or the material used for explosions. During the period 1996–2002 approximately 29 large terrorist bombings were reported globally in which 8364 casualties took place and resulted in 903 immediate deaths and 7461 injured.⁵ In the early part of 2009, use of explosive devices and materials in the global war against terrorism resulted in injuries and deaths in approximately 25,000 US and coalition forces and 100,000 Iraqis.⁶ Injuries from bomb blasts are the result of direct blast overpressure and other associated factors. In closed spaces, for example, buses, the direct blast overpressure is the key factor operating, resulting in primary blast injuries and the highest mortality.⁷ The individual in contact with or near the seat of explosion can be blown to pieces and scattered by the force of explosion gases. If a person is near enough for the skin to be in contact with the explosion flame, he can sustain the usual kind of flame burn. At greater distances, exposure to momentary heat radiation causes flash burns which can be equally serious. Therefore, the proximity of a person to the explosion is an important factor in primary blast injury and if a victim is closer to the blast overpressure he will sustain the most severe forms of blast injuries.⁸

A post-mortem examination in bomb blast cases primarily aims to document the injuries and collect evidences that will assist in the investigation into the nature and source of the explosion. This examination is divided into six phases including: (a) identification, (b) radiological examination, (c) collection of surface evidence, (d) documentation of injuries, (e) identification of natural disease and (f) collection of internal samples. The incidences of bomb blast explosion are increasing in Pakistan with the advent of the war against terrorism, which demands more trained forensic experts to carry out this scientific examination and collect the material evidences helpful to the investigating law enforcement agencies. Karachi, a thickly populated city of Pakistan, is on the edge of terrorism as the recent trend of terror bombing strikes urban settings. The objective of the terrorist is to kill and injure as many people as possible and it is obvious from the recent upsurge of incidences of bomb blasts in the city of Karachi. The aim of the

medical fraternity is to identify and resolve the immediate needs of the population, that is, to deal with the devastating effects of mass casualty incidences. This study is therefore conducted to assess the frequency of injuries and fatalities along with the age and sex vulnerability so that an effective examination, management and legal investigation can be implemented through the training of persons mainly involved in these particular catastrophic incidences.

2. Material and methods

This descriptive cross-sectional study was conducted on 1142 cases of bomb blasts, including injured persons examined medicolegally and dead bodies autopsied during the period from January 2007 to December 2011 mostly at Jinnah Postgraduate Medical Center and Civil Hospital, while few cases were reported from Abbassi Shaheed Hospital, Karachi. The study variables investigated include age, gender and year-wise distribution of the injured and the dead. Besides, the cause of death in the case of dead bodies and body parts injured or involved in the case of survivors were determined. We collected the post-mortem and medicolegal reports of all medicolegal deaths and injured persons, received at Civil, Jinnah and Abbassi Shaheed Hospital, Karachi during the study period and then sorted out those injury reports and medicolegal deaths identified to be due to bomb blasts and entered the data on the prescribed proforma.

2.1. Inclusion criteria

In this study, only those cases were included in which injuries and deaths could only be attributed to the effect of bomb blasts and brought to these three public sector hospitals of Karachi. The autopsy reports of the dead and medicolegal reports of the injured must be completed by all means to be included in the study.

2.2. Exclusion criteria

All those medicolegal cases of injuries and deaths by means other than bomb blasts or cases in which medicolegal examinations were not performed or dead bodies handed over to relatives without proper autopsy were excluded. Cases from outside Karachi if any, or carried to the private hospitals of Karachi were excluded from the study.

Data were entered in a Microsoft Excel spreadsheet and analysed using Statistical Package for the Social Sciences (SPSS) version 15. The frequency and percentages were calculated for all categorical variables.

3. Results

A total of 11,109 medicolegal autopsies were conducted during the period from January 2007 to December 2011, out of which the number of autopsies on dead bodies due to bomb blasts was reported to be 249 (2.24%). Similarly 135,065 injury cases were reported during the study period out of which 893 (0.66%) cases were due to bomb blasts (Table 1).

A total of 46 incidences of bomb blasts were reported from the South, East and Malir districts of Karachi while the Central and West districts remained unaffected. An initial peak of fatalities and casualties was observed in the year 2007, followed by a decline in the year 2008 when only one incidence of bomb blast took place with few fatalities and casualties. Since then, there has been a steady rise of bomb blast incidences with the peak of fatalities and casualties being reported in the year 2010. Highest numbers of

Table 1
Frequency of dead and injured victims of bomb blast.

Total no. of autopsies conducted during 2007–2011	Bomb blast deaths	Percentage
11109	249	2.24%
Total no. of injured cases during 2007–2011	Bomb blast injured cases	Percentage
1,35,065	893	0.66%

injured victims were reported in the year 2010 while the highest numbers of fatalities reported in the year 2007 (Table 2).

Among the 1142 cases, only 55 (4.82%) cases were female and 1087 (95.18%) cases were male with a male to female ratio of 19.76:1, indicating a clear vulnerability for males in bomb blast explosions. The young age group, that is, the persons of ages between 15 and 45 years, was chiefly involved. Similarly among the dead males, 85.06% of fatalities were observed in the age group of 15–45 years. Although few females died as a result of bomb blasts, in them the 30–45-year age group was chiefly involved. Persons of the 60 and above age group were the least affected (Table 3).

Shock due to multiple injuries was found to be the leading cause of death (62.65%). This was followed by head injury with or without haemorrhage (14.86%), injuries of chest and abdomen with or without head injury (12.05%) and chronic renal failure (5.62%). Only five bodies showed complete shattering and this was found to be the least common cause of death (4.82%) (Table 4).

In survivors, the total numbers of injuries were found to be 1375, resulting in an average of 1.53 injuries per individual. Over one-third (39.13%) of the total injuries were recorded in the lower extremities, which was the main region of the body that sustained the highest number of injuries throughout the study period. This was followed by the upper extremities, which showed 24.43% involvement. In the year 2011, the upper extremities superseded the lower extremities. The least involvement was observed in the abdomen showing only 7.93% of the total injuries (Table 5).

4. Discussion

Globally, the wave of terrorism using explosive devices has assumed an epidemic situation. It involves the innocent civilians producing major casualties and fatalities on the one hand and a financial burden on the other hand, both on the administrative institutions of governments and on the families of the victims caught in terrorist attacks. The resulting outcome in the form of volume and nature of injuries has challenged the health profession, and even the most matured and experienced institution experiences difficulty in dealing with the situation resulting from bomb blast incidences. This demands extensive preparation by health institutions to confront the magnitude of the problems associated with this kind of catastrophe.

Our study has shown considerable mortality (2.24%) and morbidity (0.66%) associated with bomb blast explosions. It is

Table 2
Frequency of bomb blast cases during the period from 2007 to 2011 at Karachi.

Year	Blasts	Persons dead	Persons injured	Total
2007	3	85	260	345
2008	1	08	26	34
2009	2	43	77	120
2010	9	65	371	436
2011	31	48	159	207
Total	46	249	893	1142

Table 3
Distribution of age and gender among the bomb blast victims ($n = 1142$).

Age	Gender					
	Male			Female		
	Injured	Dead	Total	Injured	Dead	Total
≥1 to <15	65	02	67	02	02	04
≥15 to <30	358	104	462	25	02	27
≥30 to <45	300	101	401	06	04	10
≥45 to <60	94	14	108	12	00	12
≥60	27	06	33	02	00	02
Age undetermined	02	14	16	—	—	—
	846	241	1087(95.18%)	47	08	55(4.82%)

significant in the sense that it is increasing annually and adding a further burden of non-communicable diseases, which are already on the increase and currently account for nearly half of the global burden of disease among all ages. During the 5-year study period, 46 incidences of explosions occurred in the thickly populated city of Karachi having a population above 20 million, in which 249 fatalities and 893 injured victims were reported. About two-thirds (67.3%) of the total explosions were reported in the year 2011 causing 48 fatalities and 159 casualties, a clear evidence of the increasing problem in the future. On exploring the data from 2007 to 2011, it is clear that the incidences of bomb blasts and casualties have increased many folds. Previous studies and reports from Pakistan during the period from 2006 to 2009 have reported increasing bomb blast incidences with the higher fatalities and casualties in the subsequent year. In 2006, 907 people died and 1543 were injured as a result of 657 terrorist attacks including 41 of a sectarian nature.⁹ In 2007, 1503 terrorist attacks (mostly suicidal) and target killings resulted in 3448 deaths and 5353 injured, which are 128% and 491.7% higher when compared with the years 2006 and 2005.¹⁰ In 2008, 2267 persons died and 4558 were injured as a result of 2148 terrorist attacks.¹¹ The overall situation in Pakistan became worse in 2009 when 2586 terrorist and sectarian incidences took place resulting in 3021 deaths and 7334 injured.¹² All these figures from various parts of Pakistan have reflected an increasing trend of terrorist bombing. Our study has also reflected a similar trend but the reported number of casualties and fatalities are low as compared to other parts of Pakistan. It may be due to the fact that Karachi, a big city of Pakistan, has an extended network of health-care institutions with better facilities of management in private sector hospitals; therefore, it is likely that some of the victims with less fatal injuries may be carried to the private institutions for better management and could not be reported. Another reason could be the behaviour and the protocol of law enforcement agencies, due to which the people used to avoid seeking medical advice. It has also been observed in our study that bomb blast incidences took place in the South, East and Malir

Table 4
Frequency of cause of death in bomb blast victims ($n = 249$).

Cause of death	No. of cases	Percentage
Head injury with or without hemorrhage	37	14.86%
Injury of chest and abdomen with or without head injury	30	12.05%
Shock due to multiple injuries	156	62.65%
Chronic renal failure due to shock and injuries	14	5.62%
Fragmented body remains (Shattering)	12	4.82%
	249	100%

Table 5
Frequency of distribution of injuries over body parts in injured.

Region	No. of cases					
	2007	2008	2009	2010	2011	Total
Head, neck & face	72	02	24	41	51	190 (13.82%)
Upper extremity	80	10	50	128	68	336 (24.43%)
Lower extremity	132	20	86	236	64	538 (39.13%)
Chest/thorax	61	14	18	73	36	202 (14.69%)
Abdomen	35	14	12	39	09	109 (7.93%)
Total	380	60	190	517	228	1375 (100%)

districts of Karachi while the West and Central districts were unaffected. This explains the reporting of cases chiefly from Jinnah Post Graduate Medical Center and Civil Hospital, Karachi while there were few cases from Abbassi Shaheed Hospital. The affected districts are the major sites of bus and railway terminals, thereby receiving passengers coming from upcountry areas. This helps us to reinforce security screening and record keeping of persons coming to Karachi from suspected centres of terrorism.

This study has reported males as the major victims of terrorist bombings and persons of age between 15 and 45 years are dominantly involved. A study from Dera Ismail Khan has also reported the similar trend in which all victims were male and the majority of victims were between 16 and 45 years of age.¹³ Another study from Varanasi, India has reported only male victims in the age group between 21 and 60 years in a bomb blast.¹⁴ Terrorists usually pick places where people congregate. These are the places that women avoid and males, particularly of a young age group, are keen to take an active part in the gatherings, and therefore the main victims.

Shock due to multiple injuries was found to be the leading cause of death in our study, contributing to a mortality of 62.65% of the dead victims. Multiple injuries result from penetration of flying debris and bomb fragments including steel balls, nails, screws and nuts. These projectiles acting as pellets are packed around the explosives and produce secondary blast injuries. These injuries are seen as penetrating injuries mostly on the exposed parts of the body such as head, neck and extremities. A study from Paris has reported polytrauma in 47.5% of cases and shown it to be common in bombings or explosions.¹⁵ Head injury with or without haemorrhage is reported as the second most common cause of death in the present study but is the leading region when compared with the other regions of the body. The study from Varanasi, India has reported shock and haemorrhage as the leading cause of death which was followed by coma resulting from head injury.¹⁴ A study from Istanbul, Turkey has also reported head injury as the leading cause of death when regions are considered separately.¹⁶ We included some of the head injury cases into the category of multiple injuries when found in association with injuries of limbs, chest and abdomen; therefore, shock due to multiple injuries became the leading cause of death in our study. Serious traumatic injuries with total shattering of body were observed in 4.82% of the cases which is similar to the study done in Istanbul, Turkey reporting five cases (4.2%) with complete disruption.¹⁶ This finding in victims suggests their close approximation with explosion establishing their identity as either suicidal bomber or innocent civilians unaware of the imminent incidence.

When various regions are compared in terms of injuries leading to death, thoracic and abdominal injuries account for about 12.05% of total fatalities after head injuries. This has been reported in other studies that head injuries are the leading cause of death due to bomb explosions, followed by chest injuries and burns.^{17,18} Renal failure resulting from shock and injuries contributed to 5.62% of fatalities of the total deaths. This finding suggests delayed mortality as a result of the late sequelae of injuries and haemorrhage in hospitalised victims. It also suggests the need of a well-equipped

laboratory with X-ray and computed tomography (CT) scan facilities to avoid error in detecting the injury to vital organs due to penetration of foreign bodies as it may escape detection at the time of entrance to the casualty department. These facilities are also needed while doing post-mortem examinations to give an accurate opinion of the cause of death after detecting and localising the foreign materials in various parts of the body. Besides, foreign bodies removed from the body are very helpful in deciding the nature of the explosions.^{19,20}

The study identified 1375 injuries in 893 survivors of bomb blast victims with an average of 1.53 injuries per individual. A study from Dera Ismail Khan has reported 659 injuries in 253 survivors of bomb blasts with an average of 2.6 injuries per person. Soft tissue and foreign body injuries of the lower extremities are most commonly observed in the present study which were followed by the injuries of upper extremities. This has also been reported in other studies.^{13,21} It has also been reported that the traumatic amputation of limbs is a very common phenomenon observed in bomb blast survivors.²² Victims of confined spaces tend to have higher rates of chest, abdomen and ear drum injuries while open air bomb explosions are generally associated with higher rates of soft-tissue-penetrating injuries. Our finding of the distribution of injuries in various parts of the body suggests bombing in open air.

We have to follow an effective triage with the increasing trend of bombings, so that victims of the mass casualty incidences are equally distributed to surrounding medical centres and overcrowding and saturation of the selected nearby medical institutions are avoided. It will also help in correct reporting of the fatalities and casualties of any disaster.

5. Conclusion

Fatalities and casualties as a result of explosions are increasing each year. The unique pattern of injuries of lower and upper extremities in survivors and shock due to multidimensional injuries leading to death indicate open air bombing in Karachi. It necessitates the need for strict vigilance and patrolling of law enforcement agencies to keep a strict eye on loitering people particularly in the South, East and Malir districts of Karachi.

Victims particularly males of the age group between 15 and 45 years, who are breadwinners, are mainly affected. These incidences, therefore, not only cause loss of life of loved ones but also place a psychological and financial burden on the affected families. Intervention strategies to re-establish the affected families are necessary so that they can be effective members of the community.

With the increasing activities of terrorists, the forensic speciality needs to develop a good understanding of their role in examining the injured and doing proper autopsy in the dead to produce accurate certification.

Ethical approval

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Conflict of interest

All authors participated in the design of the study, data analysis and preparation of manuscript. Capt. Dr. Farhat Hussain Mirza and Dr. Hamid Ali Parhyar conceived the idea, prepared proforma for data collection and analysed and interpreted the data. Capt Dr. Farhat Hussain Mirza and Dr. Syed Zubair Ahmed Tirmizi did extensive literature search, reviewed the manuscript and retrieved the relevant references as well. They finally developed and wrote the main manuscript of the article. Dr. Hamid Ali Parhyar collected

the data and participated in data analysis and writing initial draft of the article.

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